

REMARKS

The Applicants thank the Examiner for the thorough examination of the application. It is believed that no new matter is added to this application by this Amendment.

Status Of The Claims

Claims 1, 2, 6-9, 12-15, 17-21, 25-27 and 30-33 are pending in the application. Claims 6, 7, 12, 13, 17 and 18 are objected to. Claims 6, 12 and 17 have been amended to clarify their language, and the amendments to these claims find support in Figures 3, 5, 6, 7, 10 and 11.

Objections To The Claims

The Examiner objects to claims 6, 7, 12, 13, 17 and 18 as being unclear. The Examiner asserts that in the limitation "the magnetic sensor includes a hard magnetic layer and a soft magnetic layer, and wherein the magnetization layer is changed depending on an induced magnetic field from the signal wire" needs clarification.

Claims 6, 12 and 17 have been amended to recite: "the magnetic sensor includes a soft magnetic layer near to the signal wires and a hard magnetic layer over the soft magnetic layer, and wherein the magnetization direction of the soft magnetic layer is changed depending on an induced magnetic field from the signal wire." This combination of elements is typically shown in Figure 10 of the application.

The functioning of the magnetic sensor of the present invention may be better understood by considering the technical aspects of magnetoresistance (MR) technology. The simple structure of an MR sensor includes a pinned layer, a spacer layer made of non-magnetic materials (such as Cu) on the pinned layer, and a free layer on the non-magnetic material. The pinned layer is made of a ferromagnetic material such as Co, because its magnetized direction should not be affected by the external magnetic forces (that is, the magnetic force for sensing). The free layer is made from a ferrimagnetic material such as Ni, because it should easily change its magnetized direction according to the external magnetic force. Among the elements of the earth materials, there are only three materials suitable for the magnetic applications: Co, Fe and Ni. Co and Fe are known as the ferromagnetic materials and Ni is known as the ferrimagnetic material.

When there is no external magnetic force, the free layer is affected by the pinned layer. Therefore, the magnetic direction of the free layer is the same as the pinned layer. If an external magnetic force is applied, then the free layer

changes its magnetizing direction according to the external force. At that time, the free layer is governed by the external force. When the magnetizing direction of the free layer is changed, the magnetoresistance between the pinned layer and the free layer changes. By detecting this change of magnetoresistance, the magnetic direction of the external magnetic force can be detected.

If the external magnetic force is overly large so as to affect the pinned layer, the MR sensor cannot work properly. If the external magnetic force is so weak as to not change the direction of the free layer, then the MR sensor will also not work properly. The MR sensor is generally used to detect very small magnetic forces. That is, the detecting range of the MR is limited to magnetic forces that cannot affect the pinned layer to magnetic forces that can affect the free layer. Mixing in other materials such as Pt, G Cu etc. can moderate the pinned layer and the free layer to the desired scope of the application.

As a result, in light of the amended claims and a knowledge of the background of MR technology, the claim limitations are clear.

Double Patenting Rejection

Claims 1, 2, 8, 9, 14, 15, 19-21, 25, 27 and 30-33 are provisionally rejected on the grounds of obviousness-type double patenting over claims 1, 2, 5-7, 11 and 15-21 of copending application no. 10/670,373, which matured into U.S. Patent 7,009,405 on March 7, 2006. Applicants traverse.

Although the applicants do not acquiesce to the propriety of this rejection, a terminal disclaimer of U.S. Patent 7,009,405 is being filed in order to expedite prosecution.

This rejection is overcome and withdrawal thereof is respectfully requested.

Prior Art

The prior art cited but not utilized by the Examiner indicates the status of the conventional art that the invention supercedes. Additional remarks are accordingly not necessary.

Drawings

The Examiner is respectfully requested to indicate whether the drawing figures are acceptable in the next official action.

Foreign Priority

The Examiner has acknowledged the claim for foreign priority most recently in the Office Action mailed November 15, 2005. In line 12 of the Office Action Summary the Examiner asserts that no certified copies have been received. However, a certified copy of Korea 2003-28643 was filed on January

24, 2005. The Examiner is therefore respectfully requested to fully acknowledge foreign priority in the next official action.

Conclusion

The Examiner's objection and rejection have been overcome, obviated or rendered moot. No issues remain. The Examiner is accordingly respectfully requested to place the application in condition for allowance and to issue a Notice of Allowability.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Robert E. Goozner, Ph.D. (Reg. No. 42,593) at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

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R. J.

Respectfully submitted,

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